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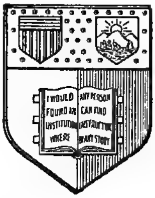

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Simple Directions for Making Visual Aids

by

MISS LILLIAN HETHERSHAW

Head of Department of Elementary Science, College of Education,
Drake University, Des Moines, Iowa.

A publication of the Department of Visual Instruction of the National
Education Association of the United States.

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SIMPLE DIRECTIONS FOR MAKING VISUAL AIDS

by

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TABLE OF CONTENTS

Introduction 5
Etched Glass Slides, using Colored Pencils 7
Etched Glass Slides, using Colored Inks 7
Paper Cut-out Lantern Slides 8
Ceramic Lantern Slides 9
India Ink Lantern Slides 9
Stillfilms 10
Cellophane Lantern Slides 11
Photographic Lantern Slides 12
Film Slides 15
The Electric Map 16
Spatter Work 18
Pencil Outlines of Leaves 19
Carbor Copies of Leaves 19
Leaf Prints from Carbon Paper 20
Blue Prints 21
Sepia Prints 22
Source of Materials 22

Active or associate membership in the Department of Visual Instruction of the National Education Association is open to anyone who may be interested in the use of visual and other sensory aids to instruction. The cost is but $2 annually, including a subscription to the combined *Educational Screen* and *Visual Instruction News,* the annual directory, reports, advisory service, etc. No other organization offers so much for so little.

INTRODUCTION

It is almost axiomatic that teaching may be enriched and learning facilitated through the application of practical methods and auxiliary devices which bring concrete experiences into the classroom.

Pupils need to be brought into direct contact with objects and phenomena about which they desire to learn, by creating situations in which they can see and handle the things which they are studying.

Sensory experience is the foundation of intellectual activity. Pupils need to be provided with more sensory experiences. They are vital to the learning process in the education of the child. In a learning situation, the child should have an opportunity to exercise as many of his sense organs as possible.

The discussion which follows is an attempt to give, in brief form, information as to how to make some suggestions concerning their possible uses. These may be made in the average classroom, as a part of the regular activity of the class, with very little expenditure for equipment and materials.

Not all the visual aids suggested in this pamphlet would be used in any one unit of work and possibly not in any one class during the school year. However, the teacher and pupils may select those which would seem best when applied to any specific situation, adapting the materials to the age and grade of the pupils.

Each type of visual aid which is mentioned in the following discussion has been tried many times in the schoolroom and has been found to be helpful. In some cases, the materials have been prepared by the pupils. In others, the teacher has made the preparation prior to the meeting of the class. It should not be difficult to determine which plan should be followed in any specific teaching situation. In every case, the teacher should dismiss from consideration the possible use of slides and other illustrative materials for entertainment purposes. Each visual or other sensory aid must make a contribution—must amplify and help build correct concepts in the mind of the child—or it has no place in the classroom.

However, any teacher who has ever worked out any of the suggested visual aids with pupils and has noted the interest and enthusiasm of the pupils when they have seen their own slides projected upon the screen or have seen their work on the bulletin boards, will await, eagerly, an opportunity to do it again.

Slides and other visual aids which pupils make must develop naturally from the unit of work or topic which the class is studying, either from an experience of an individual or from an experience of the group. There must be a correct approach to and a definite need for a slide or other visual aid, or the work has very little value. The pupils should reach a stage in the development of the unit of work where they feel not only a need but also a desire to express in a concrete way their ideas concerning some phase or phases of the unit which is being studied. Each visual aid must integrate with other things done in the unit of work, thus enriching it.

At the appropriate time, however, the making and using of the visual and other sensory aids will aid in clarifying ideas and will give an opportunity for the development of that important educational process—self expression. The different types of visual aids offer many opportunities for pupils to express themselves. Self expression helps pupils to get more meaning out of the activities in which they are engaged.

The number of slides or other aids to be made or to be used by pupils will be determined by the unit, story, or topic that is being studied, as well as by the interests and capacities of the group. The slides of "The Three Bears" (page 9) were made by a 1-A class. Six slides were made and used. A few slides, made by either the pupils or the teacher, which actually contribute to the lesson, are sufficient. Frequently, not more than one or two slides are needed in a given lesson.

The type of visual aid to be employed in any given situation should be determined by the subject or unit being studied, as well as the interests and capacities of the pupils. They should be used as need for them develops. Each visual aid which is made or used should make the unit more effective in the life of the pupil.

Visual aids will give a vital touch and concreteness to instruction in all classes of all grades—from the first through high school and college. They are not limited to any age level, but find many uses wherever the educational processes are functioning.

The lantern slides and other visual aids under discussion in this pamphlet, whether made by pupils or teachers, have a wide variety of uses. There is virtually no limit to the many intelligent uses of these visual aids in the curricula of both public and private schools. Geography, the social sciences, history, elementary science, nature study, fine and industrial art, reading, spelling, junior and senior high school sciences, are some of the courses in the curriculum which are very rich in ideas and present many opportunities for doing this type of work. "Camera Clubs," "Science Clubs," and other organizations of pupils and teachers, may make valuable contributions to a school system by making photographic slides or film slides of the environment of the school or of interesting school events. These pictures will enrich different courses and classes in the system. Furthermore, they may be used in giving assembly, club, and other group programs.

The teaching of nearly every subject in the curriculum may be made more effective and more interesting by applying some or all of these visual aids as opportunities may present themselves. All may be constructed with a minimum of effort and expense.

Directions for Making Visual Aids

Etched Glass Slides Using Colored Pencils

One of the simplest types of pupil-made lantern slides is made by using a special water color pencil on finely finished etched glass. These etched glass slides may be purchased at a cost of approximately ten cents each and may be used over and over again. A set of six colored pencils will cost but fifty cents and may be used for producing hundreds of slides.

The following suggestions will be helpful in making etched glass slides.

1. If the picture to be reproduced is a free-hand drawing, it is advisable to draw it first on a piece of paper, 3¼x4 in. in size. If a picture is to be reproduced and is less than this size, it will not be necessary to make a sketch of it. If the picture is larger than the slide size, it is usually possible to select the important part of the picture and use it. The details of the picture should be kept within a space approximately 2¼ x 3 in.
2. Lay the piece of etched glass on the drawing or picture and trace the details in outline with an ordinary medium or hard lead pencil. Mistakes in pencil marks may be removed with art gum.
3. Color the picture with the lantern slide pencils.
4. If it seems desirable to preserve the picture for future use, place a piece of plain cover glass over the colored drawing and bind the edges with lantern slide binding tape. A piece of tape fifteen inches long is required to bind the glasses all the way around. Wet the tape. Place it on a flat surface with the sticky side up. Hold the two glasses tightly together and place on edge in the middle of one end of the tape. Turn the glasses along the tape, being sure the edges are being kept in the middle of the tape, which will stick to the glasses. Then press the edges of the tape over the edges of the glasses and they will be bound securely.

If the slide is not to be used again, it will not be necessary to use the cover glass or the binding tape. Furthermore, the pictures may be removed by using a little Dutch Cleanser or similar washing powder with water, or by using a lead pencil eraser on the dry glass. A small bristle brush will be helpful if the slide is washed.

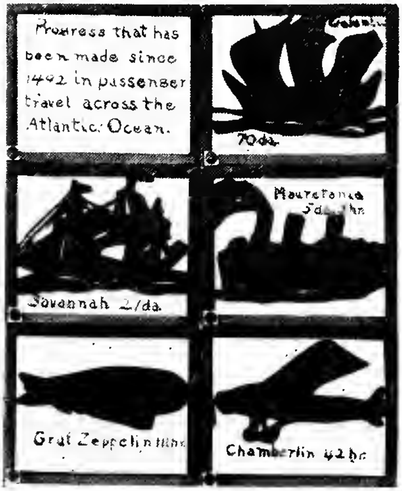
Etched Glass Slides Using Colored Inks

The chief advantage of the slides made with colored inks, over the slides made with colored pencils, is in the brilliance of the coloring. By thinning the lantern slide ink with water, beautiful light variations of the six colors may be obtained. Furthermore these colors may be mixed to form any desired shade or tint. An assortment of six colors of lantern slide ink may be purchased at a cost of $1.50.

It is possible to use the lantern slide ink on plain glass. However, the ink adheres to the etched glass better, so it is recommended that the etched glass be used in most cases. Inasmuch as the colored lantern slide ink is more difficult to use than the colored pencils, it is recommended that the ink-made slides be made by advanced students or by the teacher. If the slides are not to be used again, the pictures may be removed by using ordinary soap and water.

The usual procedure to be followed in making ink slides on etched glass would be approximately the same as for making the pencil slides. A small brush or pen should be used to color the outlines of the picture. If the ink seems too thick or too dense, thin it with water.

A second grade class was studying "The Science of Springs." One of the activities which grew out of the unit of work was to make lantern slides of 15 different birds they had observed and studied.


Progress that has been made since 1492 in passenger travel across the Atlantic Ocean.
70 da.
Mauretania 5 da.
Savannah 2/da.
Graf Zeppelin
Chamberlin 42 hr.

A Group of Cut-out Slides

They used the colored inks, and made them according to the directions for making slides using the colored pencils. Some of the lantern slides were of the red-headed wood pecker, red-winged blackbird, cardinal, blue jay, meadow lark, robin and blue bird. Only the most prominent colors were painted no each bird. The unit of work was finished by giving an assembly. As each slide was projected on the screen, a pupil gave a report of the different things learned about the bird.

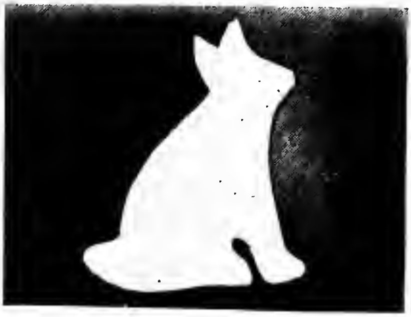
Paper Cut-Out Lantern Slides

Children in the primary grades may make their own lantern slides to illustrate such stories as "The Three Bears," "The Boy and the Goat," etc.

Let the children cut out pictures free hand, using light weight black paper, or any other paper which is near enough opaque to prevent the passing through of the light of the projector. Then select the best cut-outs and let the children paste them on ordinary cover glass. This gives a silhouette effect when projected on the screen.

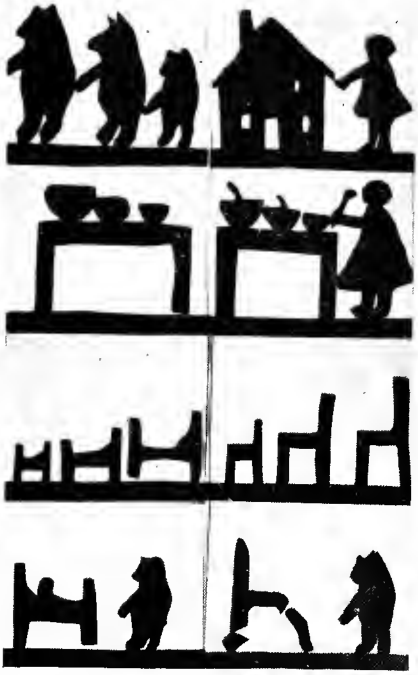
The illustration at the left will indicate something of the value of the silhouette slide among more advanced pupils. These pictures carry a definite message which contributes materially to the subject of study.

Another type of silhouette slide may be made by cutting out the figure, leaving a black background, as illustrated above.



A Silhouette Slide

The spirited enthusiasm among the pupils who are permitted to make these slides and project them before the class is certainly evidence strong enough to warrant the use of such materials whenever possible.



Cut-out Slides of "The Three Bears."

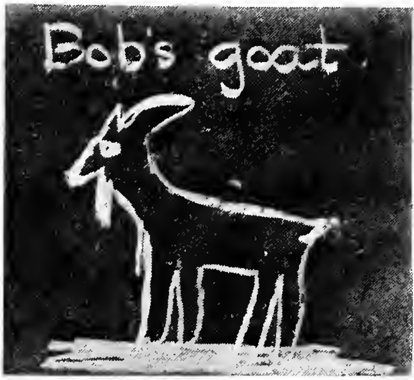
Ceramic Lantern Slides

The ceramic slide is a type of lantern slide which the children in the primary grades may make most successfully. Either cover glasses or etched glass may be used. If cover glass is used, it should be washed thoroughly or coated with a thin emulsion of clear shellac. This will cause the ceramic pencil to adhere more firmly to the surface of the slide.

Any of the special glass slides or china-marking pencils may be used to sketch the outlines. The picture may be washed off, if it is not to be preserved, and the slide is ready for use again.

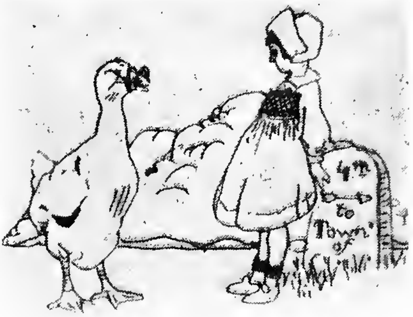
India Ink Lantern Slides

Ordinary cover glasses may be used for the India ink slides. It is necessary, usually, to wash the slides thoroughly with soap and water in order to remove any oil or other corrosion which may not permit the ink to stick to the glass. A thin coating of clear shellac may be used advantageously, also.



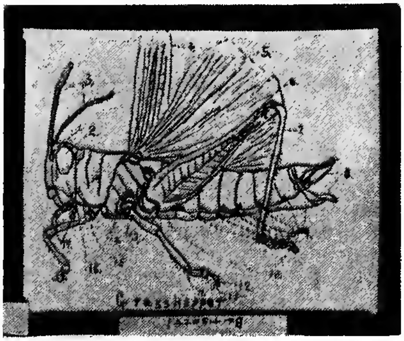
A Ceramic Pencil-Slide

There is a special pen point which is used for writing on glass, but usually any point which the pupil or teacher can use well on paper will be satisfactory.



A Simple Ink Slide

The above is an India ink slide which was made by a teacher for use during the story-telling period. Below is a diagrammatic drawing of a grasshopper.



A Home-Made Slide for Nature Study

Outline maps of states or countries may be made with India Ink for use in classes in geography, history or social sciences. Then they may be projected upon large sheets of manila paper fastened upon the blackboard or wall. While it is projected upon the paper, an outline of the map may be made with crayons or calcimine paint. Products, cities, points or interests, life of the people depicted by free hand drawings or clips may be located by different pupils or the entire map may be painted with calcimine paint to show valleys, mountains, etc. A detailed master slide might then be used for checking the accuracy of the work of the pupils.

In primary activities, in the study of "Farm Animals" or "Animals of the Circus" the same procedure may be followed. This type of work is particularly valuable in training pupils of these grades in the use of the larger arm muscles. There is no limit to the uses of the India Ink lantern slide. Both teacher and pupils will find new occasions for making them each year. The slides may also be preserved from year to year. A library of inked slides which have been made by both teacher and pupils may soon be accumulated for use in each of the different subjects.

Stillfilms

The accompanying illustration is a Stillfilm which was made by pupils in a fifth grade art class. These pupils had been studying castle life in their history classes. It will be noted at once that the strip of film has been marked off into sections about four inches in length, the same dimensions as lantern slides, which are 3¼ by 4 inches.

A Pupil-Made Stillfilm of Castle Life

The process to be used in making Stillfilms is much the same as that which is used in making India ink glass slides. The drawing or other illustration which is to appear on the Stillfilm should be constructed carefully on paper and transferred by tracing.

Although the film may be used in a glass slide projector without special equipment for holding it in place accurately, the results are not satisfactory. A sample Stillfilm attachment, which will fit any standard glass slide lantern, may be secured at small cost and the use of this attachment will insure satisfactory projection results.

The unmarked film costs about twenty cents a foot, and it is well to purchase this in five or ten foot rolls. A special film is available for use with colored inks. The chief advantage of this type of slide is that material which should appear in series can be so arranged and will remain in order permanently.

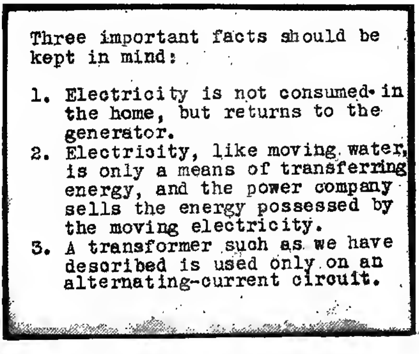
Cellophane Lantern Slides

The cellophane lantern slide is made by slipping a small sheet of cellophane, 3¼ x 4 inches in size, into a folded sheet of carbon paper and then typing on the cellophane sheet, through the carbon paper. If the typewriter does not give a good, clear impression on the cellophane sheet, remove the ribbon to permit the bare type to strike the carbon paper, as when cutting stencils.

The copy should be planned carefully and typed on paper, confined to a space approximately 2¼ x 3 inches in size, before an attempt is made to type it on the cellophane. In that way, the appearance of the slide may be made attractive by the use of proper spacing and arrangement of items to be included. It will be best to confine the copy to thirteen lines of single space typing, with thirty-two or thirty-three spaces to the line. The typing should begin at least one-half inch from the top of the cellophane sheet and three or four spaces from the left edge.

The typed cellophane sheet is then separated from the carbon paper and bound between two pieces of plain lantern slide cover glass. The binding tape may frame it entirely, or a small piece of tape on each edge will hold the glass firmly, if the slide is not to be preserved for future use. Hand-written material, drawings, tracings, etc., may be imprinted on the cellophane sheets in a similar manner also, by using a hard pencil or a stylus.

The cellophane slide is a valuable teaching tool in the hands of the busy teacher. All sorts of



Three important facts should be kept in mind:

1. Electricity is not consumed in the home, but returns to the generator.
2. Electricity, like moving water, is only a means of transferring energy, and the power company sells the energy possessed by the moving electricity.
3. A transformer such as we have described is used only on an alternating-current circuit.

Typewritten Cellophane Slide

reading exercises, outlines, and other matter, usually printed or written on the blackboard, may be put on such slides and kept for repeated use. Furthermore, pupils in the intermediate and advanced grades, including those in high school and college, may use the cellophane slides to good advantage in preparing reports and classroom discussions. The materials used are inexpensive and the results of their proper use are limited only by the energy and ability of the teacher.

On all types of slides, made by either pupil or teacher, a margin of approximately ½ inch should be left around the edges in order that all the typed or written material may be included in the field of projection. When hand lettering or writing is to be done, cross-sectioned paper laid under the glass will provide horizontal and vertical guide lines.

Photographic Lantern Slides

It is extremely difficult to avoid confusion when mentioning the various forms of lantern slides to those who are not familiar with some of those forms. The term "photographic" is used here for want of a better one to designate those slides which are made by transferring images to sensitized glass slide plates. This would include the majority of the slides which are prepared for sale, and many of those which are made by teachers for their personal use. In many cases, advanced pupils derive much pleasure from this type of work and produce excellent results.

The making of photographic lantern slides is a most fascinating undertaking and yet a rather simple process. For the beginner, the following procedure and materials have been found to be very satisfactory. After a few trials, and following directions closely, the technique will be mastered and the results will be highly satisfactory. It is well to use these simple materials until the proper handling of them has been mastered. The materials here recommended are no better, perhaps, than others on the market, but excellent results have been secured by using these and, after the slidemaker has learned the fundamentals, he may select the materials which he believes will suit his situation best.

Equipment. The first essential is a dark room. Any room which may be made absolutely dark and which has running water in it may be used as a dark room. There should be two types of electrical lighting equipment in this room; a Wratten Series "O" or a "ruby" light to be used when handling the

Lantern Slide of Trillium

sensitized plates; and a frosted 25-watt tungsten lamp to be used in making prints from the negatives. The light switches or controls should be placed on or near the work bench, so they may be convenient at all times.

Two white enameled pans, approximately 6 x 8 inches in size and 1½ inches deep, will be needed. One of these will be used for the developing chemicals and the other for water. In addition, there should be one large enameled pan, approximately 20x24x3 inches in size, to be used to contain the "fixer." An ordinary sink or some other form of tank will be needed as a place in which the slides may be "washed" as a part of the process. A simple slide rack, in which the slides may be placed while drying, is essential.

Lantern slide plates. The Eastman or any other "slow" plate is the type which will prove to be most satisfactory for the beginner, as it is less sensitive to light than the other types. The plate is a piece of clear glass, 3¼ x 4 inches in size, one side of which has been sensitized by coating it with an emulsion composed of silver bromide and silver iodide dissolved in gelatine. The emulsion side is the dull side of the slide. These are packed in boxes of twelve and the boxes should be opened only in a dark room. Furthermore, it is important that the boxes be kept closed tightly at all times except when the room is thoroughly dark or illuminated only by the red light.

Negatives. Any negative which will make a good print will make a good lantern slide. The lantern slide is merely a positive print of the negative used. When making contact prints, it is necessary that the negative be approximately 2¼x3 inches in size, or that the essential part of the negative to be transferred to the glass slide be confined to these dimensions. If materials are to be photographed for transfer to glass slides, it will be well to use a camera which accommodates a negative 2¼x3¼ inches in size. Any size of picture may be transferred to a lantern slide, of course, but the use of the smaller negative will tend to eliminate one or two processes. There are lantern slide negatives on which drawings, photographs, etc., may be recorded, and these same negatives may be used over and over again in the production of additional slides of those subjects. However, the beginner should learn the simpler processes first and the more difficult procedures may be accomplished later.

Contact printing. As mentioned above, this is a very easy method for the beginner, and very satisfactory. Simply place the emulsion or dull side of the lantern slide plate against the dull side of the negative from which the picture is to be made and hold each against the other firmly by using an ordinary printing frame, with the plate below the negative.

The 25-watt frosted tungsten lamp should be suspended about six feet above the work bench and, after the negative and plate have been fixed in place firmly, should be snapped on for about 15 seconds. Turn out the white light and continue with the developing process, using only the ruby light.

Developing. One of the simplest developing solutions is prepared by using "Nepera," or any other developer in which the various chemicals are ready-mixed. This developer is available in eight or sixteen-ounce bottles, and is inexpensive.

Mix up about one-half pint of solution, using one part of nepera by volume with four parts of water. Place this solution in one of the small enameled trays. This quantity will be sufficient for developing sixteen to twenty slides, but should not be saved from day to day.

After the lantern slide plate has been exposed, remove it from the printing frame and slide it into the tray of developer, emulsion side up. The plate should be left in the developer from one to two minutes, and only experience will make it possible for the worker to determine just when it should be removed. It should be left in the solution until the picture shows clearly on the back of the plate. Usually further development will produce a fog.

Fixing. After developing, the slide should be rinsed in plain water and then placed in the acid fixer. It should be left in the fixer for twenty minutes.

The fixing compound or "hypo" is available in one-pound packages. The contents of a package should be dissolved in two quarts of water, following the directions which are printed on the outside. The "hypo" may be used several times and this quantity will fix about a hundred slides. The solution should be kept in a brown bottle or jar, which may be covered tightly, and should be stored in a dark place.

Washing and drying. After about twenty minutes in the fixer, the slides should be placed in a tank and washed in running water for ten to fifteen minutes and then placed in a rack to dry. When more advanced work is attempted, it will be necessary to control the temperature of the solutions and water rather carefully but for this elementary work the usual temperature of tap water will be satisfactory.

Mounting slides. When the slide plate is thoroughly dry, it should be projected in a lantern for examination. If it is clear and satisfactory, it is ready to be mounted for permanent use.

A mat, which is a piece of black paper 3¼x4 inches in size with the center cut out in any desired shape and size, is placed next to the emulsion side of the slide. The opening in the mat is usually 2¼ or 2½ x 3 inches in size. After placing the mat in position, a piece of cover glass, 3¼ x 4 inches in size, is placed over it to protect the emulsion from damage. The slide plate, the mat, and the cover glass are then bound together with a strip of binding tape.

If the mat has on it a small white or gilded spot or star, this spot should be placed at the lower left hand corner of the plate. If there is no such mark on the mat, a small spot or square of gummed paper should be stuck on the outside of the cover glass, in the same position. This spot will serve as a "thumb mark" to the operator when the slide is being projected in the lantern.

Coloring slides. Lantern slides may be tinted slightly by soaking the plate in water which has been colored with pieces of Japanese water color stamps. If further tinting is desired, transparent water colors or Japanese water colors will be satisfactory. The proper coloring of lantern slides requires both patience and skill, but successful results will more than compensate for the time and energy involved.

After the pupils have made slides successfully, using the above process, they may take up the reducing and enlarging of negatives to the proper size for use in making lantern slides. This will require more equipment. The reduction and intensifying of slides may be learned. It is better, however, to try to make the negatives so well that these processes will not be necessary.

Pupils should be encouraged to make photographs of subjects which may be used in science, geography, history, agriculture, and other classes. Many subjects, such as wild flowers, birds, trees, plants and animals may be photographed in summer and the pictures transferred to slides for classroom use in winter.

The production of lantern slides is an excellent activity for a science club or a camera club. As soon as one or two pupils learn the process well, they will be glad to assist other small groups of pupils and to make special slides for classroom use. Perhaps the club may be given an opportunity to arrange the program for an assembly, at which time the slides will be used.

Film Slides

The film slide is not as easy to make in the classroom as the glass slide or Stillfilm, but it may be made quite economically after suitable equipment has been obtained. In fact, the finished slides may be made at a cost of 3c to 4c each.

The first essential in making film slides is a suitable camera. The camera used most is one which photographs still negatives on standard 35-mm. motion picture negative. The picture size is ¾ x 1 inch, and may be transferred directly to positive film for projection in any standard film stereopticon or film slide projector. These cameras range in price from $20. upward, increasing in accordance with the quality of lens used.

With this equipment, all types of material may be photographed: nature pictures; pictures of classroom experiments; pictures of important people, places, or things; charts; maps; ordinary printing; or almost anything which might be needed for projection in the classroom. It is simple to operate, and the accessory equipment may be used successfully to print film slides for projection or to make small photographs. Furthermore, the photographs may be enlarged to any desirable size with ease.

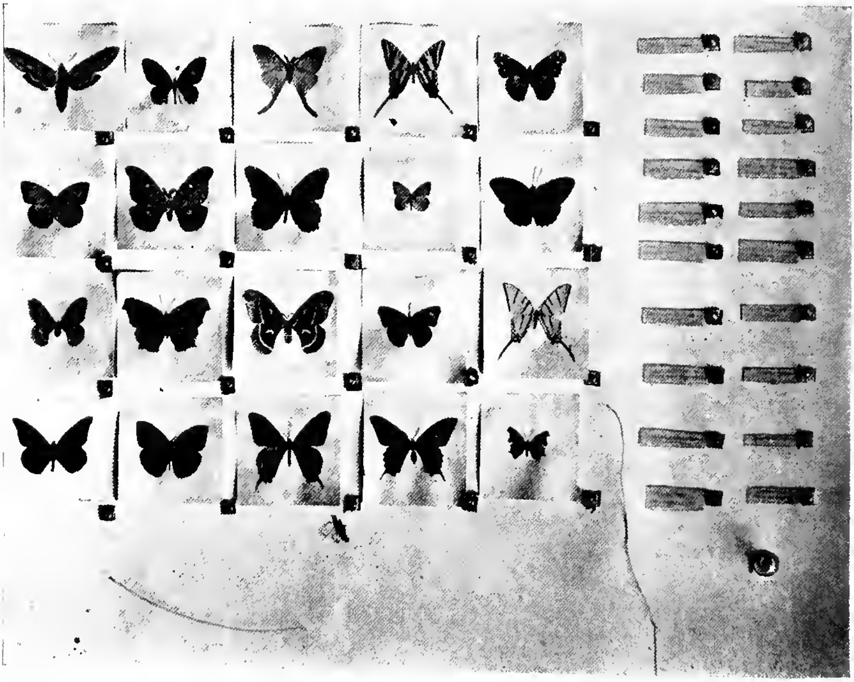
If laboratory facilities are not available, the exposed negative may be sent to a professional laboratory for developing and printing. If this is done, the finished film slides will cost about 5c each, including the cost of the negative, developing, and printing.

Another type of film slide camera is one which produces negatives 1x1½ inch in size, using 35-mm. negative but taking the picture along the film rather than across it. This size of picture must be projected in a special instrument and is not accepted generally as standard. However, for purposes of reproduction this size of picture is to be preferred to the smaller one.

These cameras range in price from $75. upward, depending upon the accessory equipment selected. This equipment is used quite extensively for scientific purposes and a special enlarger makes it possible to secure enlargements of good quality and of almost any desirable size.

The Electric Map

Another type of visual aid which contributes liberally to the learning process is the electric map. Either flat pictures or specimens may be used in the construction of such a map, and the wealth of material available in magazines and other publications offers an



Front of an Electric Map

unlimited source. Insects, leaves, pictures of birds, animals, and the like may be used extensively.

Materials needed. The first requirement is a piece of fibre board approximately 24 x 30 inches in size, or any other desired dimensions. It is better to use something through which holes may be punched readily, as this will facilitate the construction of the map. In addition, the following will be needed:

40 to 60 stove bolts, ½ inch in length.
One spool of No. 25 insulated copper wire
One "C" radio battery, 4½ volts.
One automobile head lamp, 6 volts
The specimens to be mounted on the map.

This complete set of equipment will cost about $1.50, and may be used over and over again as needed. The smaller items may be secured at any radio shop and the plaster board from a lumber yard.

Construction. The map which is shown in the accompanying illustration was arranged to accommodate twenty specimens. Spaces approximately five inches square were marked off and bolts were put through the lower right hand corner of each square. The bolt was inserted from the back and the nut screwed on from the front of the map.

At the right side of the map, twenty bolts are placed in two rows of ten each. There should be as many bolts along this side as there are in the map. These two rows should be four or five inches apart and the bolts from one to two inches from each other in the rows.

A piece of the insulated wire is used to connect one bolt in one of the two rows at the left of the map to one of the bolts at the right of the map, as shown in the picture of the reverse side of the map. Remove enough of the insulation from both ends of the wire to wrap around each bolt.

The radio battery is wired to the base of the map on the back by running wires at right angles around the battery and through the plaster board. Make a circle about ½ inch in diameter in the extreme lower left hand corner of the board and insert the socket for the lamp.

Connect one of the terminals of the battery with one of the terminals of the lamp socket. On the other terminal of the battery, connect one end of a piece of wire which is long enough that the other end will reach all of the bolts in the two rows at the right side on the front of the map. To the other terminal of the lamp socket, connect a wire long enough to reach all the bolts in the lower right hand corners of the specimen squares on the front of the map.

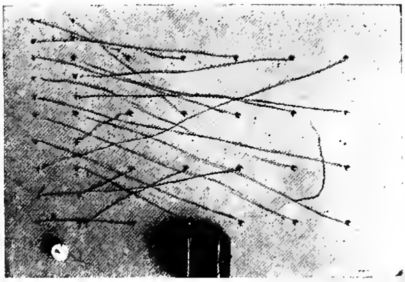
When the ends of both of the free wires are in contact with the two bolts which have been connected, that is, one on the picture of the butterfly and the other on the name of the butterfly, there will be a light.

Arranging the "map." Get a piece of two- or three-ply cardboard, the size of the plaster board used for the construction of the outfit. Cut out small square holes in the cardboard, to fit over the nuts on the front of the map, as shown in the accompanying diagram of the front of the map. Then paste the pictures or the specimens in the square spaces to the left and above the nuts.

The correct names of the butterflies or other specimens used should be typed or printed on smalll pieces of gummed paper, which may be pasted immediately to the left of the nuts in the two rows at the right. This should be done accurately, and the person constructing the map should test the identifying names to make certain that they correspond, through the wiring, with the specimens mounted in the larger spaces.

The pupil, then, may take one of two wires, place one on the nut at the corner of the specimen which is to be identified and, with the other, search among the labeled nuts at the right for the name of that specimen. When the correct name has been found and the two free wires are placed in contact with the nuts, there will be a light, as the circuit has been completed.

The electric map has been found to be a valuable aid in learning the names of objects, specimens, pictures, etc., as well as an effective device for testing such knowledge.



Back of an Electric Map

As stated above, the materials for the electric map may be secured at any good radio shop or hardware store. It may be necessary to go to the manual training department of your school or to the lumber yard to get a piece of Upson Board, Beaver Board, or other type of plaster board.

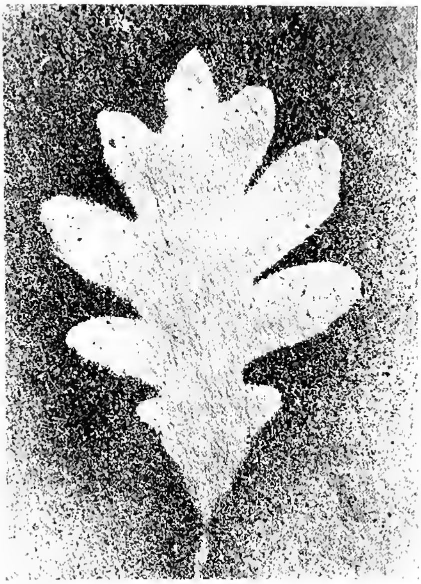
Spatter Work

The visual aids which are discussed here are both simple to construct and inexpensive. They may be used in teaching many of the different subjects of the curriculum, particularly general science and nature study, or elementary science.

Place a leaf on a piece of drawing or note-book paper of the desired size. Pin the leaf on the paper with the points near the edge of the leaf and the heads of the pins slanted toward the center of the leaf.

Dilute India water-proof ink with water. Dip a stiff toothbrush in the diluted ink and then run the bristles of the brush over the edge of a knife blade, flipping small spots of ink on and around the leaf. The pressure of the brush against the knife blade may be varied to secure small or large dots, as may be desired. When the paper is covered evenly with dots of ink around the border of the leaf, remove the pins and lift the leaf carefully. There will be a clear outline of the leaf on the paper.

Another very satisfactory



An Example of Spatter Work

method of doing spatter work is to use screening. Secure a piece of fine wre screen about 12 x 12 inches and frame it for support with thin strips of wood about ½ inch wide. Then hold this screen over the leaf and run the brush with diluted ink upon it, around the edge of the leaf. Show card paint or calcimine paints, which are available in different colors, may also be used for spatter work instead of just black ink.

Each pupil may make such an outline of a leaf which is different from the leaves used by the other pupils in the class. In this way, the pupils will soon learn the forms of all the different leaves in the neighborhood and will be able to identify trees readily.

Pupils in art classes may make attractive designs on stationery or on textiles by using the spatter method.

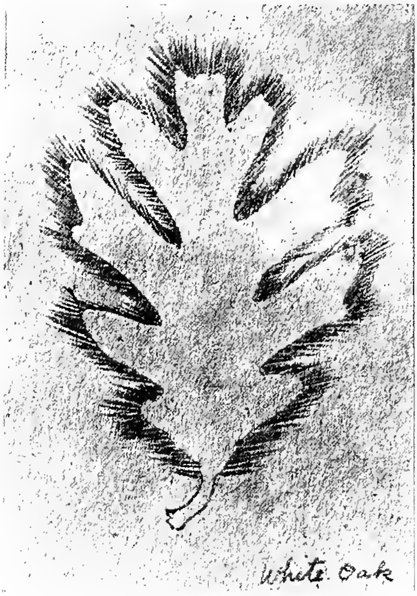
Pencil Outlines of Leaves

Place the leaf on paper of the desired size and fasten it as indicated above. Then use a drawing pencil to make short strokes from the edge of the leaf to the paper. The marks should be about one-fourth of an inch in length. Do this all the way around the leaf and along both sides of the stem.

After the entire leaf has been surrounded by the short pencil marks, remove it from the paper. The result will be an attractive penciled outline.

Carbon Copies of Leaves

Grease a piece of soft paper, such as manila wrapping paper, with some unsalted grease, such as lard, crisco, or hard oil. Apply the grease with a stiff brush or



Pencil Outline of an Oak Leaf

with a soft cloth. Blacken (carbonize) the greased surface of the paper by holding it over the flame of a candle. When very young children are making carbon prints, it is advisable to eliminate all fire hazards by blackening the bottom of a pan.

After the surface has been blackened, lay the under, or rough side of the leaf on it. Cover the leaf with a piece of clean paper and exert light pressure by rubbing over the specimen with the hand. Remove the paper and the leaf.

Place the blackened side of the leaf on a piece of clean paper of any desired size. Place another piece of paper over the leaf and exert pressure as before, being careful not to slide the leaf across the paper beneath it. Remove the upper paper and the leaf. The result will be a carbon print, showing the stem, the veins, and the edge of the leaf.

Leaf prints may be made quite successfully by using ordinary printer's ink or an ink pad such as is used with rubber stamps. The ink may be smeared over the surface of a piece of glass with a roller and the leaf colored by placing the lower side in contact with the ink. Use the method described above to transfer the print to a piece of clean paper. The same process might be used to make impressions after inking the leaf on a stamp pad.

The printer's ink and roller may be obtained from any printers' supply house. Ordinary gasoline will remove the excess ink from the glass, roller, or from the hands. It is possible to use inks of different colors, if such would seem advisable.

Small children will find it easier to use the stamp pad than either of the other methods suggested. A pad approximately three inches by four inches in size will accommodate practically all the ordinary tree leaves.

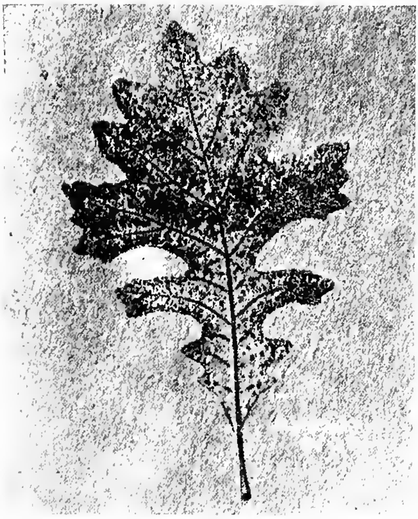
Leaf Prints from Carbon Paper

Another economical method of making carbon copies of leaves is that of using either pencil or typewriter carbon paper.

Place the under side of the leaf against the coated side of the carbon paper. Place several thicknesses of ordinary paper on top of the leaf and press with a moderately hot iron.

Remove the papers and specimen and place the carboned side

Carbon Copy of a Leaf



Carbon Print, Using Carbon Paper

of the leaf on the note paper or other paper on which the impression is to be made. Place two or three thicknesses of paper over the leaf and press again with a heated iron.

Remove the paper and the specimen. There will be left on the paper a carbon print of the leaf, showing the veins, leaf margin, and stem.

The reverse of this method may be used, giving the outline of the leaf in white, with a carbon background.

Place the leaf on the note paper or other paper upon which the print is desired. Then place the carbon paper on top of the leaf, with the carbon side next to the leaf. Put several layers of paper on top and press with a moderately hot iron.

Remove the papers and the leaf. The result will be an accurate white outline of the leaf, surrounded by the carbon background.

Blue Prints

Instead of pressing and mounting leaves of trees or flowers in the usual way, blue prints may be made of the specimens, thus keeping them in permanent form.

Blue print paper may be secured from any book store or firm which carries architect's supplies. It is not expensive.

The blue print paper should be cut into the desired sizes in a dark room with a ruby light. A "ruby" light, practical for handling blue print paper, may be made by wrapping an electric light bulb with red crepe paper. The unused paper should be stored in a dry place, wrapped in waterproof or waxed paper. In that way, it may be kept in good condition for several months. On the other hand, if moisture from the air contacts with the blue print paper, it will spoil more quickly than if exposed to light.

A weight and three or four pieces of ordinary window glass about nine by twelve inches in size are needed. Books might be used for the weight. A regular blue print frame may be used if available, but it would be somewhat unnecessary to purchase such equipment unless it is to be used frequently. The paper and specimen may be exposed to light by pressing against the window pane, if necessary.

Lay the upper side of the leaf or leaves on a piece of glass. Then place the sensitive side of the blue print paper against the leaf and glass. Place a book or weight upon the paper. Hold all these together firmly, turn the glass up, and expose the paper to bright sunlight for about two minutes. Remove the blue print paper and put it under running water until the print of the specimen stands out clearly.

Then lay the washed blue print paper on a piece of glass or hang it up on a line to dry. When nearly dry, press the sheet flat by using books or some other convenient weight.

Blue prints may be made of flowers, ferns, evergreens, grasses and leaves of all kinds. They are convenient to use, effective, and the children enjoy making them. Many have found it both interesting and convenient to use blue prints of flowers, leaves, etc., for designs on calendars, posters, and the like.

Sepia Prints

Sepia prints of flowers and leaves may be made by following the instructions for making blue prints, except that after the paper has been washed in running water until the pattern is very clear, it should be placed in a weak solution of "hypo" to set it. After leaving the print in the solution about fifteen minutes, it should be washed in running water again.

"Hypo" is one of the chemical compound used in printing pictures and lantern slides. Two table spoons of "hypo" will be sufficient to mix with one gallon of water.

The sepia prints should be dried and pressed according to the suggestions for drying and pressing blue prints. The result is the white print of the flower or leaf with a soft light brown background.

A Blue Print of a Fern

Sources of Materials

The materials to be used in slide making are carried in stock regularly by leading photographic supply houses, but certain organizations have specialized in this type of service and are ready to give every assistance to those who are interested in making slides.

For example, the materials pictured in the accompanying illustration will be found to be extremely convenient for those who are interested in making any type of glass slide. The equipment is kept together in a neatly arranged box and all the accessories are readily accessible.

The materials to be used in making slides,—either the home-made slide or the photographic slide,—and film slides are carried in stock regularly by leading photographic supply houses. But certain organizations have specialized in this type of equipment and service, and are ready to give assistance to those who are interested in making slides of all types.

The following sources are thoroughly reliable and will give prompt attention to all inquiries concerning the construction of different types of lantern slides; the educational values and possibilities of slides; and sources of equipment and materials:

Bureau of Visual Instruction, University Extension Division, Lawrence. Kansas.

Visual Instruction Department, College of Education, Drake University, Des Moines, Iowa.

Keystone View Company, Meadville, Pennsylvania.

Eye Gate House, Inc., 126 West 46th Street, New York, N.Y.

Eastman Kodak Company, Rochester, New York.

Hall Stationery Company, 623 Kansas Avenue, Topeka, Kansas.

Burke & James, Inc., 223 West Madison St., Chicago, Illinois.

Those who may be interested in equipment to be used in photographing directly on film slide negative should write to the Bureau of Visual Instruction, University Extension Division, Lawrence, Kansas, or to one of the following:

Agfa-Ansco Corporation, Binghampton, New York.

E. Leitz, Inc., 60 East 10th Street, New York, N.Y.

Society for Visual Education, 327 South La Salle Street, Chicago, Ill.

Spencer Lens Company, Buffalo, New York.

If information is desired concerning the cost of having photographs, drawings, etc., transferred to film slides, it will be well to write to either of the following:

Society for Visual Education, Inc., 327 South LaSalle Street, Chicago, Ill.

Spencer Lens Company, Buffalo ,N.Y.

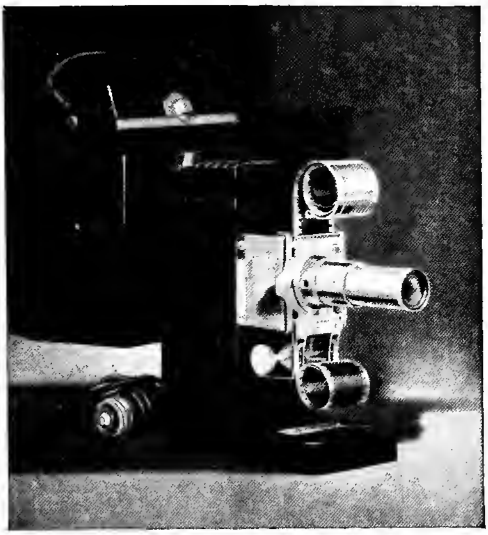
Keystone Home-Made Slide Outfit

Materials to be used in making Stillfilms should be secured from Stillfilm, Incorporated, 4701 West Pico Boulevard, Los Angeles, California.

The following vary in cost depending on quality:

1. Plain glasses or cover glasses from 1c to 2¼c each.
2. Etched glasses cost from 1c to 10c each.
3. Ceramic pencils, 10c to 25c each.

MEMOSCOPE



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